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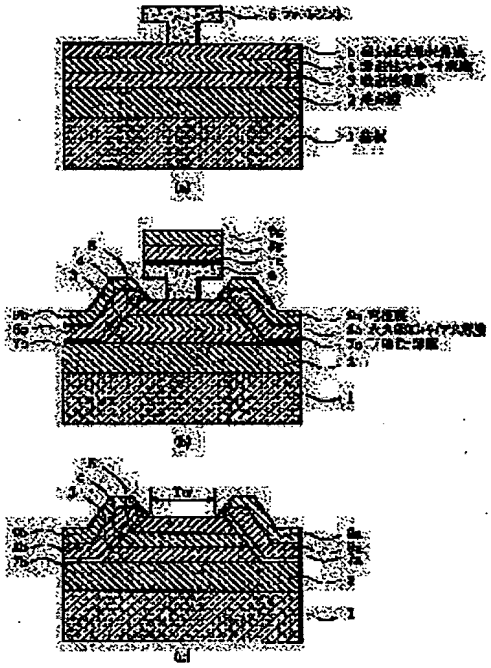
(54) PERMANENT MAGNET BIAS TYPE MAGNETO-RESISTIVE HEAD AND ITS PRODUCTION

(57)Abstract:
PURPOSE: To obtain a permanent magnet bias type magneto-resistive head which is capable of impressing a stable longitudinal bias to a magneto-optical film, is low in heat generation and noise, has excellent corrosion resistance and high reliability and is inexpensive.
CONSTITUTION: This permanent magnet bias type magneto-resistive head is constituted by disposing laminated films consisting of permanent magnet bias ground surface films having electrical and magnetical continuity, permanent magnet bias films and electrode films at both ends of a magneto-resistive sensor working region. CoCrPt allay films contg. ≤10 to 12atm.% Cr and ≤12 to 15atm.% Pt are used for the ground surface Cr thin films 7a to 7c and the permanent magnet bias thin films 8a to 8c and TaMo alloy films having ≤10 to 40atm.% Mo compsn. are used for the electrode films 9a to 9c. The Ar content in the respective films is suppressed to ≤3atm.%. As a result, the desired permanent magnet bias type magneto-resistive head is obtd.



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* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] The permanent magnet bias mold magneto-resistive effect head to which said permanent magnet bias substrate film is characterized by being the chromium film in the permanent magnet bias mold magneto-resistive effect head which has the structure which arranged the cascade screen which consists of the permanent magnet bias substrate film, permanent magnet bias film, and electrode layer which have a continuity electrically and magnetically in the both ends of the magneto-resistive effect sensor operating space which consists of a soft magnetism thin film, a nonmagnetic spacer thin film, and a magneto-resistive effect thin film at least on a substrate.
[Claim 2] The permanent magnet bias mold magneto-resistive effect head according to claim 1 to which said chromium film is characterized by containing the argon of 3 or less atomic percent.

[Claim 3] The permanent magnet bias mold magneto-resistive effect head according to claim 1 or 2 characterized by being the cobalt chrome platinum alloy film with which said permanent magnet bias film contains 10 or more atomic percent chromium of 12 or less atomic percent, and contains 12 or more atomic percent platinum of 15 or less atomic percent.
[Claim 4] The permanent magnet bias mold magneto-resistive effect head according to claim 3 to which said cobalt chrome platinum alloy film is characterized by containing the argon of 3 or less atomic percent.
[Claim 5] Said electrode layer is the permanent magnet bias mold magneto-resistive effect head of four given in any 1 term from claim 1 to which the presentation of molybdenum is characterized by 10 or more atomic percent being the tantalum molybdenum alloy film it is [film] 40 or less atomic percent.
[Claim 6] The permanent magnet bias mold magneto-resistive effect head according to claim 5 to which said tantalum molybdenum alloy film is characterized by containing the argon of 3 or less atomic percent.
[Claim 7] A spatter is used for said chromium film and it is 2 0.5W/cm in a 0.1-pascal or more argon gas ambient atmosphere with a pressure of 0.5 pascals or less. It is 2 1.6W/cm above. The manufacture approach of the permanent magnet bias mold magneto-resistive effect head characterized by having the process which forms membranes with the following power density.
[Claim 8] A spatter is used for said cobalt chrome platinum alloy film, and it is 2 0.5W/cm in a 0.1-pascal or more argon gas ambient atmosphere with a pressure of 0.5 pascals or less. It is 2 1.6W/cm above. The manufacture approach of the permanent magnet bias mold magneto-resistive effect head characterized by having the process which forms membranes with the following power density.
[Claim 9] A spatter is used for said tantalum molybdenum alloy film, and it is 2 0.5W/cm in a 0.1-pascal or more argon gas ambient atmosphere with a pressure of 0.5 pascals or less. It is 2 1.6W/cm above. The manufacture approach of the permanent magnet bias mold magneto-resistive effect head characterized by having the process which forms membranes with the following power density.
[Claim 10] It sets to said spatter and power density is 2 0.3W/cm. The manufacture approach of the electrode thin film of nine given in any 1 term from claim 7 characterized by impressing the following bias power.

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the permanent magnet bias mold magneto-resistive effect head which reads information according to a magneto-resistive effect in more detail about the magnetic head for reading information in a magnetic-recording medium, and its manufacture approach.
[0002]
[Description of the Prior Art] In the magneto-resistive effect head, the manufacture approach using the stencil by the permanent magnet bias mold magneto-resistive effect head and photoresist in which the permanent magnet film is prepared in the both ends of the sensor operating space of the magneto-resistive effect film, and has shelf structure is indicated by JP,3-125311,A etc. Here, the permanent magnet bias film impresses magnetic bias to the magneto-resistive effect film, stabilizes magnetic-domain structure, and is bearing the important role for changing into a single magnetic-domain condition.
[0003]
[Problem(s) to be Solved by the Invention] Although various temperature hysteresis, such as heat treatment of the photoresist for carrying out patterning, is generally added in the manufacture process of a magneto-resistive effect head, we are anxious about the stability and dependability of magnetic properties of the permanent magnet bias film in the process. Furthermore, it feels uneasy also about exfoliation by the internal stress of those film in a manufacture process.
[0004] The purpose of this invention does not have exfoliation of the permanent magnet bias substrate film, the permanent magnet bias film, and an electrode layer in the manufacture process. By maintaining the value which is not different from a membrane formation design value after the magnetic properties of the permanent magnet bias film pass through the various temperature hysteresis in a production process The vertical bias stabilized on the magneto-resistive effect film can be impressed, and it is in offering the permanent magnet bias mold magneto-resistive effect head and its manufacture approach of the high-reliability excellent in the corrosion resistance of low generation of heat and a low noise by low cost.
[0005]
[Means for Solving the Problem] This invention is characterized by to use the chromium film, the cobalt chrome platinum alloy film, and the tantalum molybdenum alloy film for said permanent magnet bias substrate film, the permanent magnet bias film, and an electrode layer in a permanent magnet bias mold magneto-resistive effect head with the structure which arranged the cascade screen which consists of the permanent magnet bias substrate film, the permanent magnet bias film, and the electrode layer which have a continuity electrically and magnetically, respectively to the both ends of the magneto-resistive effect sensor operating space which consists of a soft magnetism thin film, a nonmagnetic spacer thin film, and a magneto-resistive effect thin film at least on a substrate
[0006] Moreover, the cobalt chrome platinum alloy film contains 10 or more atomic percent chromium of 12 or less atomic percent. And 12 or more atomic percent platinum of 15 or less atomic percent is contained, and the presentation of molybdenum of the tantalum molybdenum alloy film is with an atomic percent of 10 or more 40 or less atomic percent. All these film uses a

	試料A		試料B		試料C	
	熱処理前	熱処理後	熱処理前	熱処理後	熱処理前	熱処理後
残留磁束密度(G)	8115	8042	7989	7829	7077	6653
変化率(%)	±0	−0.9	±0	−2.0	±0	−6.0

[0019] According to Table 1, the change rate of the residual magnetic flux density after this heat treatment in Sample A became somewhat large with −2.0% by Sample B to −0.9 being% and being small good, and it turned out by Sample C that it decreases still more greatly with −6.0%.
[0020] Although it now is not necessarily clear about the cause by which a residual magnetic flux density decreases by heat treatment, in order for the structural relaxation by heat treatment to occur and to lessen structural relaxation as one of them, it is required for distortion to produce little good film of lattice matching. Moreover, Ar content in [a certain thing to] the film of their being 3 or less atomic percent is [the effect which the behavior of Ar atom which is chemical inertness has on structural relaxation] desirable.
[0021] The power density at these things to the time of membrane formation is 2 1.6W/cm. What is necessary is it to be desirable that it is 0.5 pascals or less as for Ar gas pressure, and for the conditions which the discharge at the time of carrying out a spatter generates and maintains to stability just to prescribe the lower limit of these membrane formation conditions hereafter.
[0022] If the CoCrPt alloy film makes [many] the content of Cr and Pt, in order for a residual magnetic flux density to decrease and to impress the vertical bias field of the suitable magnitude for the magneto-resistive effect film, it is necessary to thicken the thickness and a manufacture price rises. Moreover, since a residual magnetic flux density will become large if the content of Cr and Pt lessens, it is necessary to make thin thickness for acquiring a suitable vertical bias field but, and if it does so, dispersion in the vertical bias field by dispersion in thickness needs to become large, and needs to make control of the thickness on manufacture stricter. Furthermore, as for reduction of Pt presentation, it turns out that corrosion resistance gets worse.
[0023] As for these things to the CoCrPt alloy film, it is desirable to contain Cr of 10 or more atomic percent the presentation of 12 or less atomic percent and Pt of 12 or more atomic percent the presentation of 15 or less atomic percent.
[0024] Drawing 3 was drawing showing Mo presentation dependency of the specific resistance of a TaMo alloy thin film, the spatter was used for this TaMo alloy film on the glass substrate, and R.F. bias power density produced it on condition that 0 and Ar gas ambient atmosphere where 0.3W /of 1.2W /of 2 and pressures are [cm / 2 and membrane formation power density / cm] 0.3 pascals, respectively.
[0025] When drawing 3 is referred to, Mo presentation decreases rapidly with 15 or more atomic percent, and the specific resistance of the TaMo alloy film which the specific resistance of the TaMo alloy film changed with Mo presentations a lot, and was produced on the non-bias using the spatter is 2 0.3W/cm. When produced with bias power density, Mo presentation decreases rapidly with 10 or more atomic percent, and serves as 40-60micro ohm-cm.
[0026] Since corrosion resistance will get worse if Mo content in the TaMo alloy film is made [many], as for Mo presentation, it is desirable that they are 40 or less atomic percent. Moreover, in order for applied voltage, a re-spatter, etc. to receive a bad influence in case a magneto-resistive effect head component is manufactured if the bias power at the time of spatter membrane formation is increased, bias power density is 2 0.3W/cm. It is desirable that it is the following.
[0027] Sample D and Sample E were further produced as a sample for evaluation of each functional film following the samples A, B, and C mentioned above.
[0028] (4) Laminating membrane formation of the TaMo film containing Mo of the CoCrPt film which uses a spatter and contains Cr of Cr film with a thickness of 100A and 10.7 atomic percent with a thickness of 400A and Pt of 13.9 atomic percent on a sample D silicon substrate in membrane formation power density 2 and Ar ambient atmosphere with a pressure of 0.3 pascals of 1.4W/cm, and 29.0 atomic percent with a thickness of 500A was carried out.

pressure of 0.3 pascals of 1.4W/cm The substrate Cr thin films 7a, 7b, and 7c with a thickness of 100A, The film permanent magnet bias thin films 8a, 8b, and 8c which consist of CoCrPt alloy film containing Cr of 10.7 atomic percent with a thickness of 300A, and Pt of 13.9 atomic percent, And laminating membrane formation of the electrode layers 9a, 9b, and 9c which consist of TaMo alloy film containing Mo of 29.0 atomic percent with a thickness of 500A is carried out.
[0040] Finally, when drawing 1 (c) was referred to, electrode layer 9c which consists of the photoresist 6 in the operating space Tw as a magneto-resistive effect sensor, substrate Cr thin film 7c, CoCrPt alloy permanent magnet bias thin film 8c, and TaMo film was removed using organic solvents, such as an acetone, and the permanent magnet bias mold magneto-resistive effect head component was produced. At this time, in order to remove a photoresist 6 completely promptly, ultrasonic cleaning etc. may be used together.
[0041] And this permanent magnet bias mold magneto-resistive effect head component performed installation of a pressurization spring, a support arm, etc., wiring to an electrode, etc., and produced the permanent magnet bias mold magneto-resistive effect head while it performed slider processing with the well-known technique.
[0042] Thus, the vertical bias which does not have exfoliation of the film in a manufacture process and was stabilized on the magneto-resistive effect film could be impressed, moreover, component resistance was as small as 18 ohms, and generation of heat and a noise were stopped small by this, and the produced magneto-resistive effect mold head was excellent also in corrosion resistance. Moreover, there were few noises by heat also about reproducing characteristics, and the good playback wave without a Barkhausen noise or wave asymmetry was acquired.
[0043] In addition, the same result will be obtained if the permanent magnet bias mold magneto-resistive effect head of this invention is within the limits of the following [presentation / of each functional film].
[0044] The CoCrPt alloy film may contain 10 or more atomic percent chromium of 12 or less atomic percent, 12 or more atomic percent Pt of 15 or less atomic percent may be contained, and the presentation of Mo of the TaMo alloy film should just be with an atomic percent of 10 or more 40 or less atomic percent.
[0045] Furthermore, when forming these film, a spatter is used, and it is 2 0.5W/cm in 0.1-pascal or more Ar gas ambient atmosphere with a pressure of 0.5 pascals or less. It is 2 1.6W/cm above. Forming membranes with the following power density, especially the TaMo alloy film is 2 0.3W/cm. Membranes are formed by the bias spatter which impresses the bias of the following power density, and the argon content in the film should just be 3 or less atomic percent.
[0046]
[Effect of the Invention] As explained above, according to this invention, in a manufacture process, there is no exfoliation of the permanent magnet bias substrate film, the permanent magnet bias film, and an electrode layer. By maintaining the value which is not different from a membrane formation design value after the magnetic properties of the permanent magnet bias film pass through the various temperature hysteresis in a production process Component resistance is still smaller, and the vertical bias as the design stabilized on the magneto-resistive effect film can be impressed, and it is [generation of heat and a noise are small made by it, and] effective in the ability to offer the permanent magnet bias mold magneto-resistive effect head and its manufacture approach of of the high-reliability and a low price excellent in corrosion resistance.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the sectional view showing the notional production process of one example of this invention.
[Drawing 2] It is drawing showing the relation between Ar content in the film of a sample (samples A, B, and C), and membrane formation power density.
[Drawing 3] It is drawing showing Mo presentation dependency of the specific resistance of a TaMo alloy thin film.
[Drawing 4] It is drawing showing the temperature dependence of the internal stress of a sample (sample D).
[Drawing 5] It is drawing showing the temperature dependence of the internal stress of a sample (sample E).
[Description of Notations]
1 Substrate
2 Insulator Layer
3 Soft Magnetism Thin Film
4 Nonmagnetic Spacer Thin Film
5 Magneto-resistive Effect Thin Film
6 Photoresist
7a, 7b, 7c Substrate Cr thin film
8a, 8b, 8c Permanent magnet bias thin film
9a, 9b, 9c Electrode thin film
Tw Magneto-resistive effect mold sensor operating space

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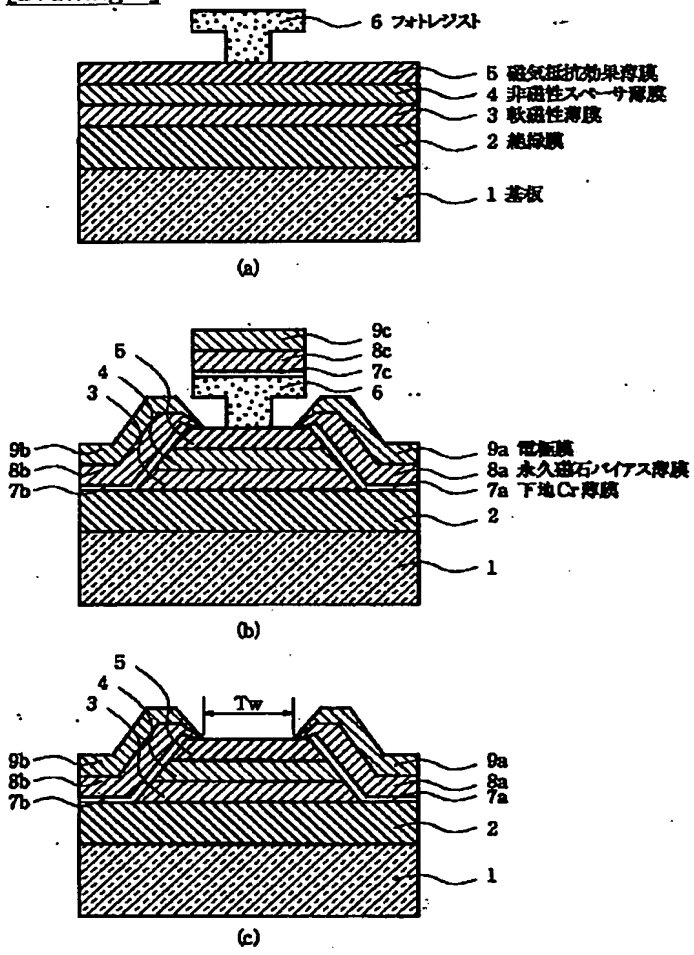
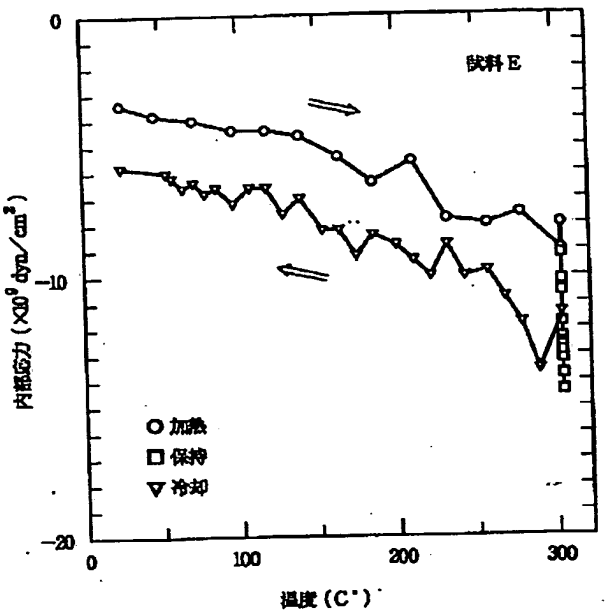
DRAWINGS

[Drawing 1]



[Drawing 2]



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